Validation of Automated Event Triggers Using Laboratory Values Related to Two Problem-Prone Drugs

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Abstract

We used computerized alerts to identify patients with laboratory values that could be related to medication errors associated with digoxin and warfarin. Over a six-week period at two inpatient facilities, we generated 62 laboratory-based alerts for warfarin, and 66 for digoxin. The positive predictive value for these alerts representing a preventable event was 71% and 57% for warfarin and digoxin, respectively.

Introduction

Most healthcare organizations rely upon passive reporting systems for patient safety events, which detects a minority of these events.[1] Medication errors are a common form of medical error that results in substantial morbidity in hospitalized patients.[2] In this study, we used computerized alerts to identify patients with laboratory values that could be associated with medication errors involving digoxin and warfarin.

Methods

Hospitalized patients with International Normalized Ratios (INR) greater than 5 at two BJC Healthcare facilities who had received warfarin with 21 days, or had an INR greater than 4 and received vitamin K, and patients with digoxin levels greater than 2 ng/ml were identified using a real-time clinical database. Clinical pharmacists were notified via a daily automated intranet e-mail list. Using a standardized instrument, pharmacists then performed chart reviews to determine whether the alert represented a preventable event, to assess patient harm and to identify the type of error resulting in the event. At Barnes-Jewish Hospital (BJH), two pharmacists then rescored a random selection of alerts that they had not previously scored, and inter-rater agreement for the question of whether the alert represented a preventable event was assessed using the kappa statistic. An alert was considered valid if it was scored as a definitely, probably, or possibly preventable event.

Results

Between December 01, 2002 and February 14, 2003, we identified 62 inpatients with either an INR > 5 or an INR > 4 in conjunction with vitamin K administration, and 66 inpatients with a digoxin level > 2. All warfarin alerts were evaluable and all but one digoxin alerts were evaluable. The positive predictive values (PPV) for these alerts are shown in the Table. At BJH, kappa statistics for assessing whether the alert represented a preventable event were 0.74 for digoxin and 0.20 for warfarin, with an overall kappa of 0.54 (95% CI 0.16-0.91). Some degree of patient harm was considered present in 53% of warfarin alerts and 66% of digoxin alerts. The most common sources of error for warfarin were inappropriately high initial dosing or prescription of interacting medications and, for digoxin, failure to adjust dosing for abnormal renal function. Only one of the events identified by the automated system had been reported in a passive reporting system.

Table. Positive predictive value (PPV) for alerts triggered by laboratory values associated with digoxin and warfarin.

Drug	Valid	Not Valid	PPV
Warfarin	44	18	71%
Digoxin	37	28	57%

Conclusions:

Using an automated notification system to identify hospitalized patients with elevated INR and digoxin levels detected medication errors that were not reported in passive medication error reporting systems. These alerts had acceptable positive predictive values but variable inter-rater reliability for assessing preventability. The information learned from this exercise is now being used to devise interventions to prevent these types of medication errors. The system developed to identify these errors will be used to monitor the impact of these interventions.

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References

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